Saskatchewan

# A D F

Agriculture Development Fund

# FINAL REPORT

## PARASITES AND PARASITE CONTROL FOR FARMED BISON AND ELK

**19990141**

**Funded by**
**The Agriculture Development Fund**

**October 2001**
**Prepared by: University of Saskatchewan**

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# ADF Project 19990141
# Parasites and Parasite Control Strategies for Farmed Bison and Elk

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## SUMMARY

This study used a postal survey to assemble baseline data on Saskatchewan bison and elk producers' perceptions of parasites and parasitic diseases, and their use of anti-parasite medications, and a fecal survey to assemble data on the occurrence of selected parasites in farmed bison and elk.

Response rates for the postal survey were 44.7% of 282 bison producers and 40.3% of 315 elk producers. The fecal survey included 22 bison producers and 20 elk producers in all regions of the province.

The major findings were as follows:

- Few bison or elk producers check their animals for parasites. A wide range of internal parasites was detected in bison and elk as a result of these checks.

- Few bison producers (7.3%) and a greater proportion of elk producers (23.6%) reported parasite-related health problems in their animals in 1998.

- In both bison and elk, the diagnoses of parasite problems were most often made by the producers themselves. Several producers involved veterinarians in the diagnoses.

- In bison, parasite-related health problems were most often diagnosed by fecal examination. In elk, diagnosis was most often by visual examination of the animals. These differences are the result of the producers' perceptions of the parasites responsible for the problems.

- In bison, gastro-intestinal worms, intestinal coccidia and lice appear to be parasites most often responsible for health problems. In elk, the parasites are ticks and lice.

- Most bison producers (84.9%) and almost all elk producers (96.9%), reported using anti-parasite medications during 1998. Most bison and elk producers used these medications once or twice during the year.

- While both bison and elk producers reported using once-yearly anti-parasite medications in most months of the year, there were peaks in use in the fall which, in bison, extended into the early winter.

- Most bison (79.5%) and elk (73.3%) producers reported giving anti-parasite medications to their calves at weaning.

- A wide range of anti-parasite medications, in a variety of combinations, were used by bison and elk producers. Other than eprinomectin in elk, these are off-label uses. By mouth or injection are the most common means of administration.

- For both bison and elk producers, the major sources of information on anti-parasite medications were other producers, veterinarians and magazines.

- Some animals on all bison farms, and on most elk farms, were infected with trichostrongyle nematode parasites (see Appendix C for information on the various parasites).

- For bison and elk 14% and 10%, respectively, of the animals sampled had trichostrongyle egg counts greater than 100 eggs per 5 grams of feces. Maximum egg counts were 547 and 347, respectively. The significance of these higher counts is unknown.

- The other gastro-intestinal nematodes (*Nematodirus*, *Strongyloides* and *Trichuris*) were rarely found in either bison or elk.

- *Moniezia* (tapeworms) and coccidia were found commonly in bison and less commonly in elk. For both these parasites, levels of infection (as assessed by fecal egg/oocyst counts) were higher in bison than in elk.

- Eggs of the liver fluke, *Fascioloides magna*, were not found in any of the bison or elk surveyed.

- As far as we are aware, the data from the postal survey are the first available on bison and elk producers' perceptions related to parasites and parasite control.

- In terms of parasites identified and levels of infection as assessed by fecal egg counts, the results of the fecal survey are consistent with other (limited) investigations of both free-ranging and farmed bison and elk. The absence of *F. magna*, which has been reported from farmed elk in Alberta, is perhaps surprising. Also, in a recently published survey of farmed bison in Alberta (Dies and Coupland, 2001, *Canadian Veterinary Journal* 42, 295-296), the intestinal nematode *Capillaria* was found on 14 of 22 (63.6%) of farms surveyed.

***Note:*** It was planned to visit each of the farms included in the fecal survey twice during the summer, and to examine the fecal samples for lungworm larvae. Logistical considerations made it impossible to include these two aspects of the study.

## THE REPORT

### *Introduction*

The objectives of this project were to assemble baseline data on Saskatchewan bison and elk farmers' perceptions of parasites and parasitic disease in their livestock, on the methods they use for parasite control, and on the occurrence of selected parasites in farmed bison and elk.

The first and second objectives were achieved using a postal survey. The second was achieved by a fecal survey of from bison and elk on a number of farms in Saskatchewan. Both phases of the study were completed during 1999.

## POSTAL SURVEY

### *Materials and Methods*

In the spring of 1999, 21-(bison) or a 19-item (elk) questionnaires (Appendices A and B) were mailed to 282 bison farmers and 315 elk farmers in Saskatchewan. The mailing lists were provided by the Saskatchewan Bison Association and the Saskatchewan Elk Breeders' Association, and include most producers in the province. The questionnaires sought information on herd characteristics, parasitic infections and diseases, and on parasite control strategies.

### *Results*

#### ♦ *Response Rates*

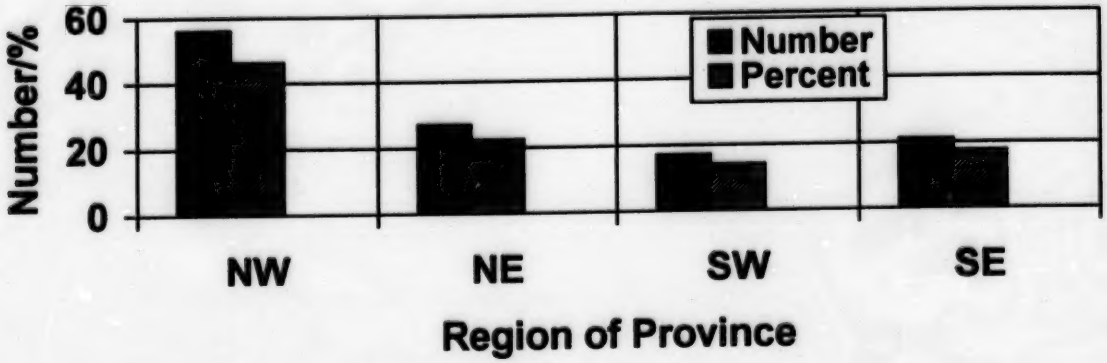
Completed questionnaires were returned by 126 bison farmers and 127 elk farmers. These response rates (44.7% and 40.3%, respectively) are considered very good for a survey of this type.

The principal data from the questionnaires are presented in the following text and annotated Figures and Tables. The data are for calendar 1998. Note that not all questions were answered in all returned questionnaires.

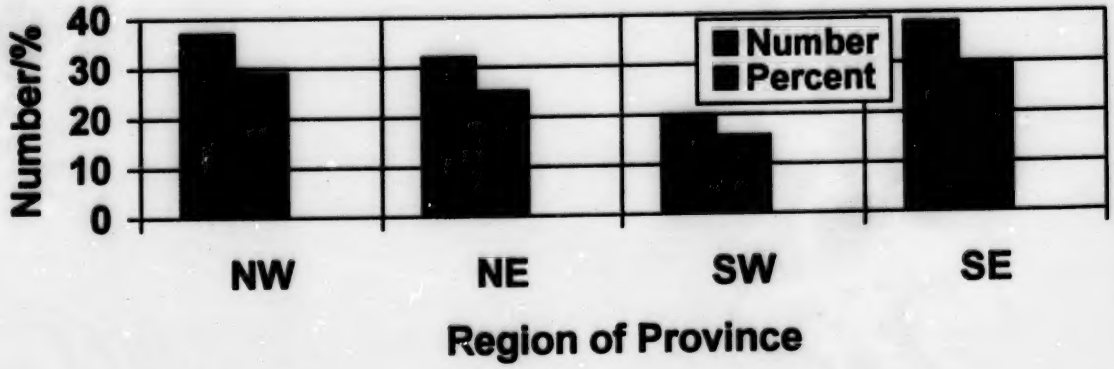
♦ ***Farm Information***

Figures 1 and 2 show the distribution of responding producers among the four geographic regions within the cultivated area of Saskatchewan.

## Fig 1. Bison: Survey Response Rates (121 Producers Responsed)




## Fig. 2 Elk: Survey Response Rates (127 Producers Responsed)



*Bison and Elk Question 1*

Figures 3 and 4 show herd size of responding producers.

**Fig. 3 Bison: Herd Size (126 Producers Responded)**

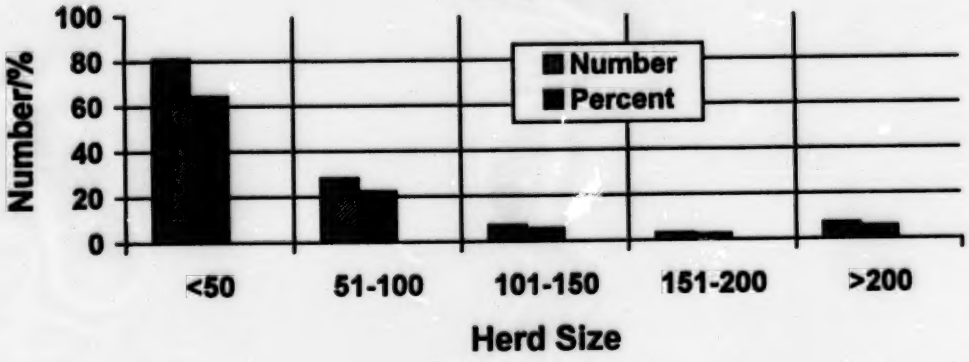
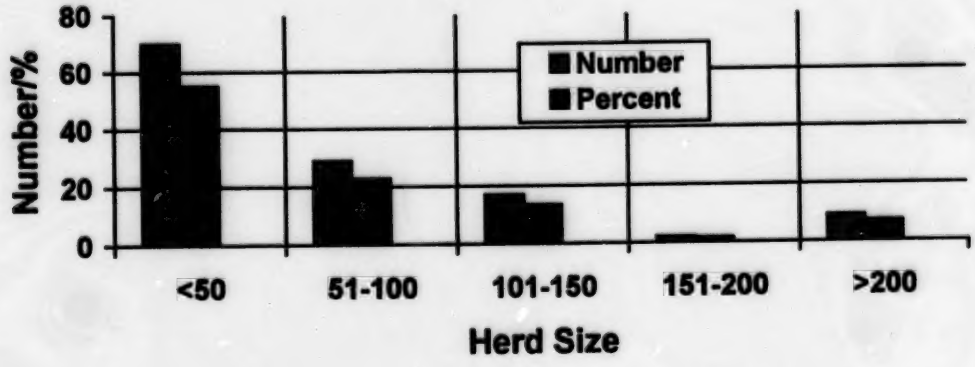



**Fig. 4 Elk: Herd Size (127 Producers Responded)**




For both bison and elk, more than 50% of responding producers had less than 50 animals, and more than 75% had less than 100 animals.

*Bison Question 2*

For bison, only 19 of 125 responding producers maintained their animals in feedlots year round.

*Bison Question 3; Elk Question 2*

For responding producers, the mean acreage used for summer grazing for bison was 283 (range 10 to 3,000), and for elk 132 (range 4 to 2,000).

The mean stocking rates were 4.55 acres/bison (range 20.00 to 0.13) and 1.79 elk/acre (range 7.69 to 0.20). Note that these data are approximate; they were calculated from the median in each herd size class.

*Bison Questions 4 and 5; Elk Questions 3 and 4*

Among bison producers, 70 of 123 responding (56.9%) used pasture rotation, with a mean rotation interval of 5 weeks (range 2 to 17). For elk, 75 of 126 responding producers (59.5%) used pasture rotation, with a mean interval of 5.4 weeks (range 2 to 14).

*Bison Question 6; Elk Question 5*

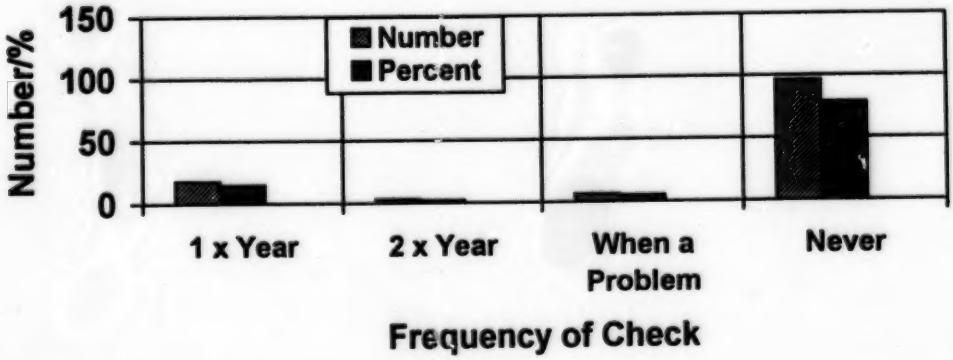
For bison, 94 of 123 responding producers (76.4%) reported using some pastures during both summer and winter. For elk, 108 of 122 (88.5%) reported a similar practice.

♦ ***Parasites on your Farm***

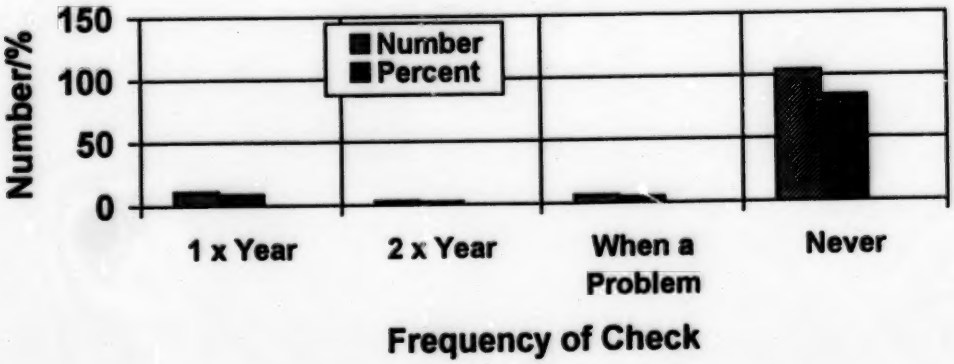
*Bison Question 7; Elk Question 6*

Figures 5 and 6 show data for the frequency of parasite checks.

## Fig. 5 Bison: Frequency of Parasite Checks (123 Producers Responded)




## Fig. 6 Elk: Frequency of Parasite Checks (124 Producers Responded)




For bison, 96 of 123 producers (78.1%) reported never checking their animals for parasites during 1998. For elk producers the figure was 104 of 124 (83.9%).

*Bison Question 8; Elk Question 7*

Figures 7 and 8 show the types of parasites found as a result of the checks in 1998. Note that for both bison and elk, these data are from a small number of producers.

**Fig. 7 Bison: Parasites Detected (13 Producers Responded)**

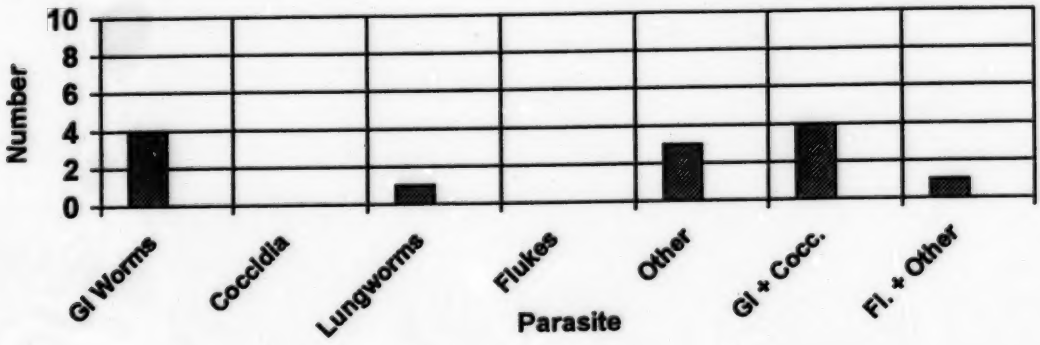
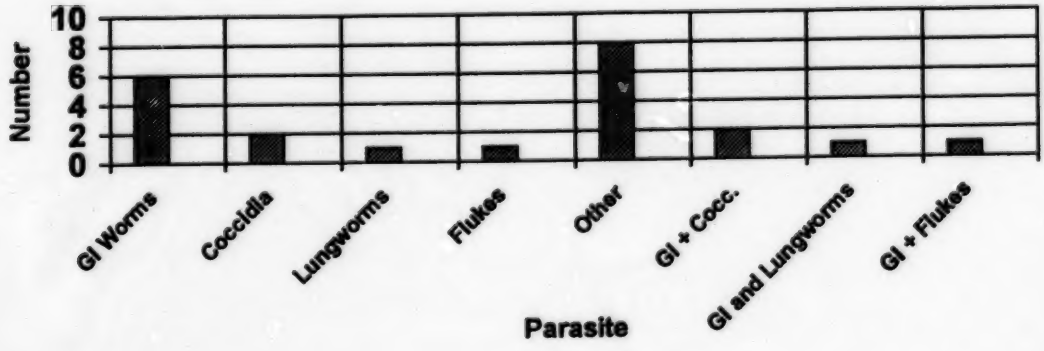



**Fig. 8 Elk: Parasites Detected (22 Producers Responded)**




The "Other" category includes primarily lice or ticks, or both.

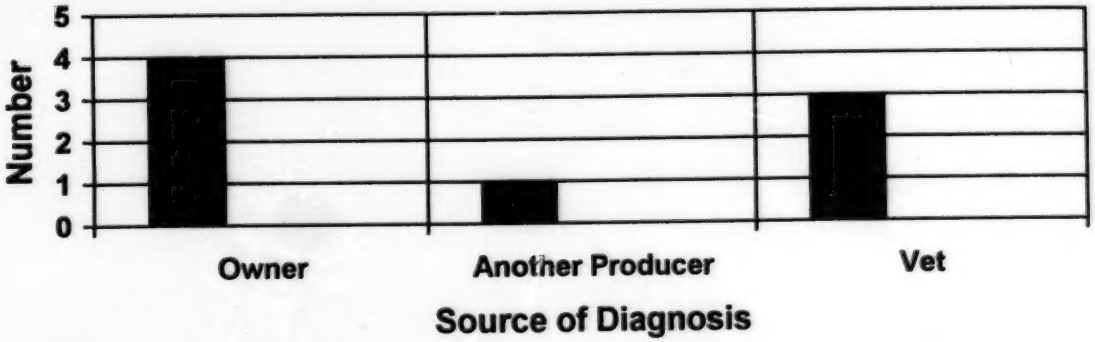
*Bison Question 9; Elk Question 8*

For 1998, 9 of 124 (7.3%) of bison producers, and 30 of 127 (23.6%) of elk producers, reported parasite-related health problems in their animals.

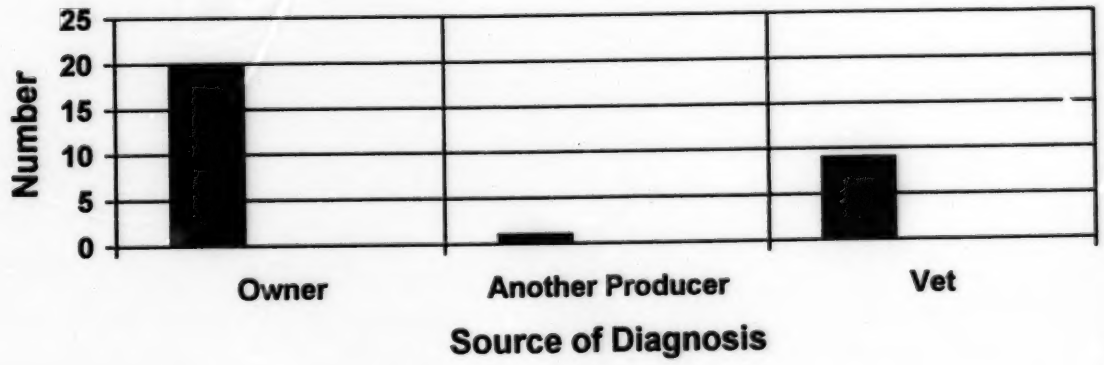
*Bison Question 10; Elk Question 9*

Figures 9 and 10 show who made the diagnoses of the parasite-related health problems that occurred during 1998. Note that the responses for bison were from a small number of producers.

## Fig. 9 Bison: Source of Parasite Diagnosis (8 Producers Responded)



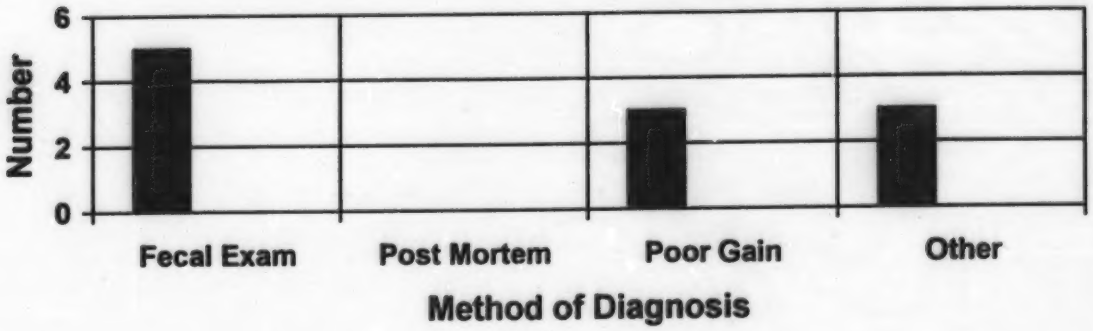

## Fig. 10 Elk: Source of Parasite Diagnosis (30 Producers Responded)



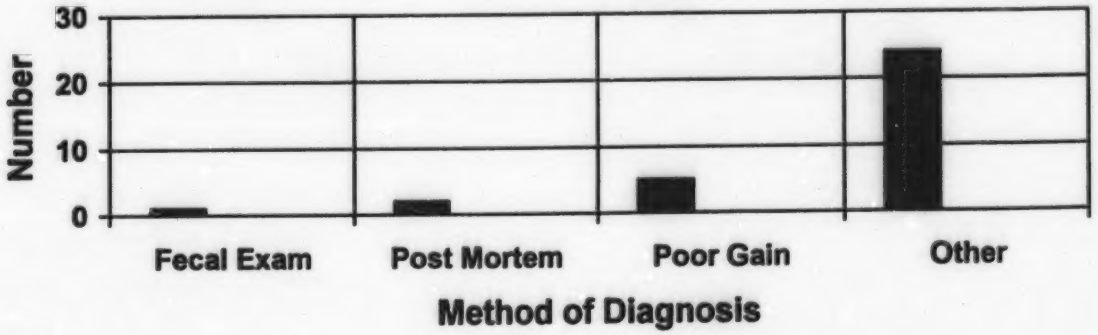
*Bison Question 11; Elk Question 10*

Figures 11 and 12 show how the parasite-related health problems were diagnosed. Note that the data for bison are from a small number of producers. Note also that an individual producer may have reported more than one diagnostic method. Among the "other" techniques used on elk, visual detection of ectoparasites was the most commonly reported.

## Fig. 11 Bison: Method of Parasite Diagnosis (8 Producers Responded)




## Fig. 12 Elk: Method of Parasite Diagnosis (31 Producers Responded)




The "Other" category includes visual detection of lice or ticks, or both.

*Bison Question 12; Elk Question 11*

Figures 13 and 14 show the types of parasites identified by the producers as responsible for the health problems in their animals. For bison, few producers identified such problems.

**Fig. 13 Bison: Parasite Problems (7 Producers Responded)**

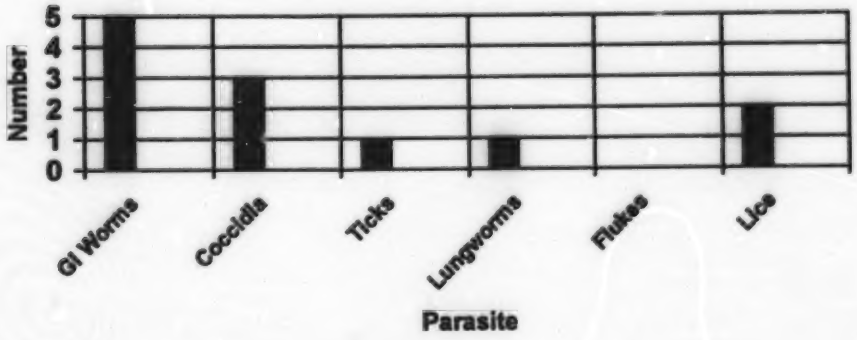
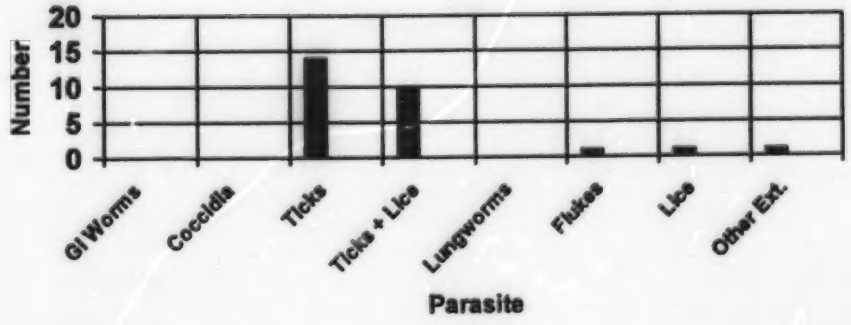



**Fig. 14 Elk: Parasite Problems (27 Producers Responded)**




Among bison, the parasites most commonly identified were GI worms (nematodes), while among elk they were ectoparasites, especially ticks (presumably *Dermacentor albipictus*).

♦ ***Anti-Parasite Medication Use on your Farm***

*Bison Questions 13 and 14; Elk Question 12 and 13*

Among bison producers, 107 of 124 (84.9%), and among elk producers 123 of 127 (96.9%), reported using anti-parasite medications during 1998.

Figures 15 and 16 show the frequency of use of anti-parasite medications.

**Fig. 15 Bison: Anti-Parasite Treatment Frequency (100 Producers Responded)**

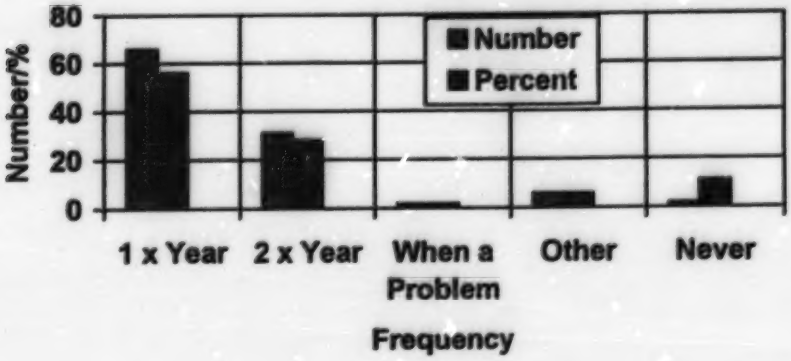
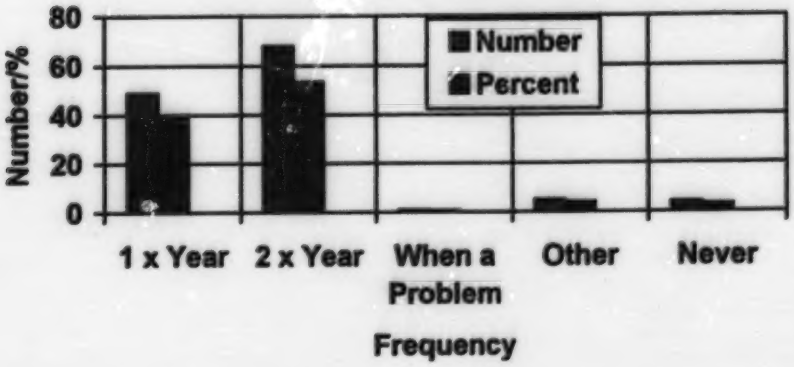



**Fig. 16 Elk: Anti-Parasite Treatment Frequency (127 Producers Responded)**




The six bison producers who answered "other" to this question gave diatomaceous earth free-choice to their animals. The four elk producers who answered "other" used anti-parasite medications three times during 1998.

*Bison Question 15; Elk Question 14*

Figures 17 and 18 show the distribution by month of once yearly treatments of adult male bison and elk. Figures 19 and 20 show the data for adult females.

**Fig. 17 Bison: Anti-Parasite Treatment Timing - Adult Males Treated Once per Year (78 Producers Responded)**

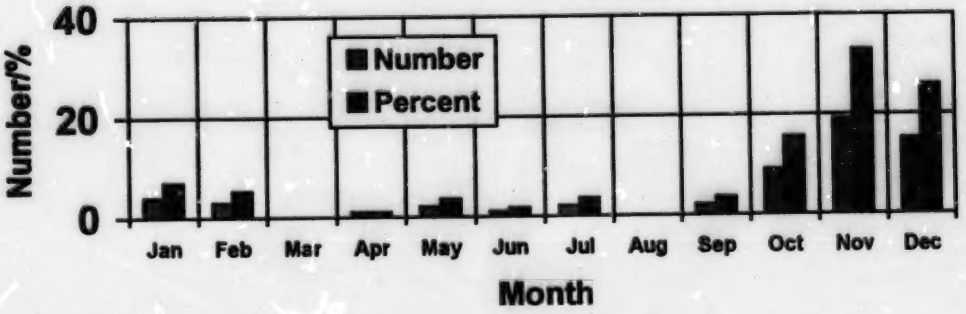
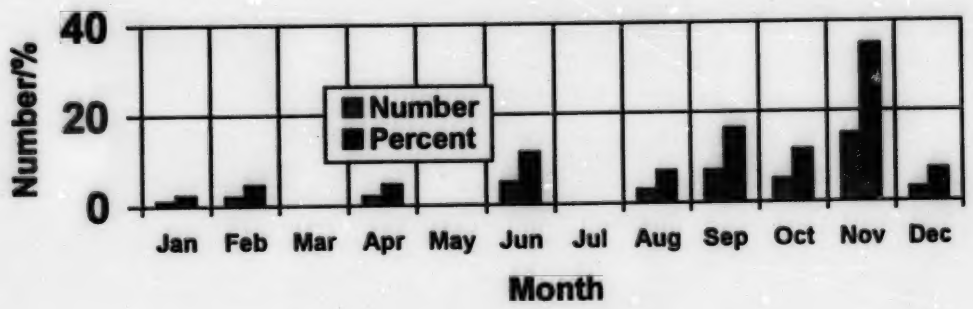
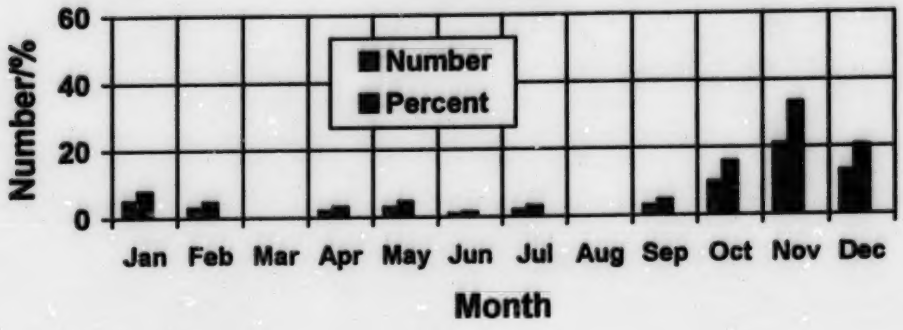


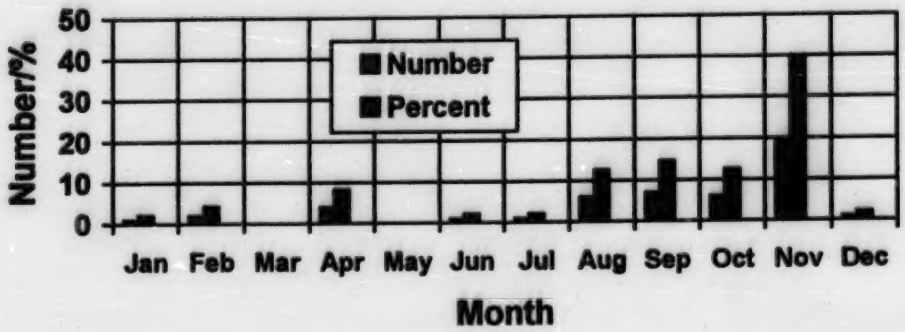

**Fig. 18 Elk: Anti-Parasite Treatment Timing - Adult Males Treated Once per Year (43 Producers Responded)**



## Fig. 19 Bison: Anti-Parasite Treatment Timing - Adult Females Treated Once per Year (63 Producers Responded)




## Fig. 20 Elk: Anti-Parasite Treatment Timing - Adult Females Treated Once per Year (48 Producers Responded)




For both bison and elk and for both adult males and females, these data show treatment "peaks" in the fall.

For adult male and female bison, the data show twice-yearly treatments in all months, with "peaks" in April and May and in October and November. For elk also, twice yearly treatments are administered in all months, but no "peaks" are readily apparent, although adult females were rarely treated in May through July.

The apparent absence of "peaks" for elk may be associated with winter treatment for ectoparasites, especially ticks, identified by producers as an important problem in this species.

*Bison Question 16*

Of producers responding, 79 of 110 (72%) reported weaning their calves in 1998.

*Bison Questions 17and 18; Elk Questions 15 and 16*

For bison, 62 of 78 producers (79.5%) reported giving anti-parasite treatment to their calves at weaning, and 16 of 100 reported treatment of calves at other times of the year. Approximately 50% of these producers indicated that these other treatments were given in October or November.

For elk, 88 of 120 producers (73.3%) reported anti-parasite treatment of calves at weaning, and 47 of 118 producers (39.8%) reported treatment of calves at other times of the year. As with bison, almost 50% of these other treatments were given in October or November.

*Bison Question 19; Elk Question 17*

The responses to this question are shown in Tables 1 and 2.

**Table 1: Bison: anti-parasite medications used in 1998 (109 Responses).**

| Product | Number | Percent | Cumulative Number | Cumulative Percent |
|---|---|---|---|---|
| Ivomec | 52 | 48.0 | 79 | 54.0 |
| Ivomec, Cydectin, Dectomax | 1 | 0.9 | | |
| Ivomec, Cydectin, Dectomax, Fasinex, Safeguard | 1 | 0.9 | | |
| Ivomec, Cydectin, Dectomax, Safeguard | 1 | 0.9 | | |
| Ivomec, Cydectin, Other | 2 | 1.8 | | |
| Ivomec, Dectomax | 1 | 0.9 | | |
| Ivomec, Safeguard | 16 | 14.7 | | |
| Ivomec, Other | 5 | 4.6 | | |
| Cydectin | 3 | 2.8 | 9 | 6.0 |
| Cydectin, Safeguard | 1 | 0.9 | | |
| Dectomax | 4 | 3.7 | 9 | 6.0 |
| Dectomax, Safeguard | 1 | 0.9 | | |
| Fasinex | | | | |
| Rumensin | | | | |
| Safeguard | 13 | 12.0 | 34 | 23.0 |
| Safeguard, Other | 2 | 1.8 | | |
| Valbazen | | | | |
| Other | 5 | 4.0 | 14 | 9.5 |
| Eprinex | 1 | 0.9 | 1 | 0.6 |

Within the "other" category were diatomaceous earth, Levasole®, Neguvon®, and an 8-way vaccine, mistaken for an "anti-parasite medication".

**Table 2: Elk: anti-parasite medications used in 1998 (124 Responses).**

| Product | Number | Percent | Cumulative Number | Cumulative Percent |
|---|---|---|---|---|
| Ivomec | 43 | 34.7 | 88 | 41.1 |
| Ivomec, Eprinex | 3 | 2.4 | | |
| Ivomec, Cydectin | 2 | 1.6 | | |
| Ivomec, Cydectin, Dectomax, Fasinex. Safeguard | 1 | 0.8 | | |
| Ivomec, Cydectin, Dectomax, Valbazen | 1 | 0.8 | | |
| Ivomec, Cydectin, Dectomax, Valbazen, Other | 1 | 0.8 | | |
| Ivomec, Cydectin, Safeguard | 1 | 0.8 | | |
| Ivomec, Cydectin, Valbazen | 1 | 0.8 | | |
| Ivomec, Cydectin, Other | 2 | 1.6 | | |
| Ivomec, Dectomax | 3 | 2.4 | | |
| Ivomec, Dectomax, Eprinex | 1 | 0.8 | | |
| Ivomec, Dectomax, Fasinex | 1 | 0.8 | | |
| Ivomec, Dectomax, Rumensin, Valbazen, Other | 1 | 0.8 | | |
| Ivomec, Safeguard | 1 | 0.8 | | |
| Ivomec, Safeguard, Other | 3 | 2.4 | | |
| Ivomec, Valbazen | 7 | 5.7 | | |
| Ivomec, Other | 11 | 8.9 | | |
| Eprinex | 2 | 1.6 | 11 | 5.1 |
| Eprinex, Other | 1 | 0.8 | | |
| Cydectin | 10 | 8.1 | 31 | 14.5 |
| Cydectin, Dectomax, Fasinex, Safeguard | 1 | 0.8 | | |
| Cydectin, Dectomax, Fasinex, Other | 1 | 0.8 | | |
| Cydectin, Safeguard | 5 | 4.0 | | |
| Cydectin, Safeguard, Eprinex | 1 | 0.8 | | |
| Cydectin, Valbazen | 1 | 0.8 | | |
| Cydectin, Other | 1 | 0.8 | | |
| Cydectin, Safeguard | 1 | 0.8 | | |
| Dectomax | 2 | 1.6 | 14 | 6.5 |
| Decetomax, Other | 1 | 0.8 | | |
| Fasinex | 0 | 0 | 4 | 1.9 |
| Rumensin | 0 | 0 | 1 | 0.6 |
| Safeguard | 1 | 0.8 | 21 | 9.8 |
| Safeguard, Other | 1 | 0.8 | | |
| Safeguard, Eprinex | 1 | 0.8 | | |
| Valbazen | 1 | 0.8 | 17 | 7.9 |
| Valbazen, Eprinex | 1 | 0.8 | | |
| Valbazen, Other | 1 | 0.8 | | |
| Other | 1 | 0.8 | 27 | 12.8 |
| No Response | 3 | | 3 | |

There were 27 responses within the "other" category. Treatments included: Cooper's Delice® (10 responses); Lice-Off® (2); Lice Guard® (2); and an unspecified louse powder (2); Neguvon® (1); and an 8-way vaccine, mistaken for an "anti-parasite medication" (5).

*Bison Question 20; Elk Question 18*

Tables 3 and 4 show the means of administration of anti-parasite medications.

**Table 3 Bison: Means of Administration of Anti-Parasite Medications (108 Responses).**

| Means of Administration | Number | Percent | Cumulative Number | Cumulative Percent |
|---|---|---|---|---|
| In feed | 18 | 16.7 | 40 | 27.4 |
| In feed, drench | 7 | 6.5 | | |
| In feed, drench, injection | 1 | 0.9 | | |
| In feed, injection | 14 | 13.0 | | |
| Drench | 16 | 14.8 | 38 | 26.0 |
| Drench, injection | 6 | 5.6 | | |
| Drench, pour-on | 1 | 0.9 | | |
| Injection | 41 | 38.0 | 63 | 43.2 |
| Injection, pour-on | 1 | 0.9 | | |
| Pour-on | 3 | 2.8 | 5 | 3.4 |

**Table 4 Elk: Means of Administration of Anti-Parasite Medications (124 Responses).**

| Means of Administration | Number | Percent | Cumulative Number | Cumulative Percent |
|---|---|---|---|---|
| In feed | 1 | 0.8 | 19 | 10.0 |
| In feed, drench, pour-on | 4 | 3.2 | | |
| In feed, injection | 3 | 2.4 | | |
| In feed, injection, pour-on | 3 | 2.4 | | |
| In feed, pour-on | 8 | 6.4 | | |
| Drench | 3 | 2.4 | 28 | 14.7 |
| Drench, injection | 1 | 0.8 | | |
| Drench, injection, pour-on | 3 | 2.4 | | |
| Drench, pour-on | 17 | 13.7 | | |
| Injection | 8 | 6.4 | 35 | 18.4 |
| Injection, pour-on | 17 | 13.7 | | |
| Pour-on | 56 | 45.2 | 108 | 56.9 |

*Bison Question 21; Elk Question 19*

Tables 5 and 6 show the sources of information on parasites and anti-parasite medications used by producers.

**Table 5 Bison: Sources of Information on Parasites and Anti-Parasite Medications (112 Responses).**

| Means of Administration | Number | Percent | Cumulative Number | Cumulative Percent |
|---|---|---|---|---|
| Vet | 19 | 17.0 | 63 | 33.9 |
| Vet, other producers | 18 | 16.1 | | |
| Vet, producers, industry magazines | 17 | 15.2 | | |
| Vet, producers, magazines, other | 1 | 0.9 | | |
| Vet, producers, other | 1 | 0.9 | | |
| Vet, magazines | 4 | 3.6 | | |
| Vet, other | 3 | 2.7 | | |
| Producers | 28 | 25.0 | 74 | 39.8 |
| Producers, magazines | 8 | 7.1 | | |
| Producers, other | 1 | 0.9 | | |
| Magazines | 5 | 4.5 | 36 | 19.4 |
| Magazines, other | 1 | 0.9 | | |
| Other | 6 | 5.4 | 13 | 7.0 |

There were 13 responses indicating "other" sources of information: feed companies and feed stores (5 producers); conferences and industry meetings (2); personal experience (3); medication manufacturer (1); an American veterinarian (1); and unidentified (1).

**Table 6 Elk: Sources of Information on Parasites and Anti-Parasite Medications (124 Responses).**

| Means of Administration | Number | Percent | Cumulative Number | Cumulative Percent |
|---|---|---|---|---|
| Vet | 36 | 29.0 | 89 | 42.6 |
| Vet, other producers | 25 | 20.2 | | |
| Vet, producers, industry magazines | 21 | 16.9 | | |
| Vet, producers, magazines, other | 1 | 0.8 | | |
| Vet, magazines | 4 | 3.2 | | |
| Vet, other | 2 | 1.6 | | |
| Producers | 22 | 17.7 | 77 | 36.8 |
| Producers, magazines | 8 | 6.4 | | |
| Magazines | 1 | 0.8 | 36 | 17.2 |
| Magazines, other | 1 | 0.8 | | |
| Other | 3 | 2.4 | 7 | 3.4 |

There were seven responses indicating "other" sources of information: conferences and industry meetings (5 producers); personal experience (1); and one producers is a veterinarian.

## POSTAL SURVEY

### *Materials and Methods*

Approximately five bison farms and five elk farms were selected at random from each of the four geographic regions (north-west, north-east, south-east and south -west) of the cultivated area of Saskatchewan. Totals of twenty-two bison and twenty elk farms were included. Three of the farms had both bison and elk. Each farm was visited once during the four summer months of 1999 and fecal samples were collected from not less than 10% of the animals present, taking care to include animals of both sexes and all age groups.

Fecal samples were transported to the laboratory on cold packs and frozen until examined. All samples were examined using a quantitative flotation technique which detects one or more parasitic worm egg or coccidial oocyst in 5 grams of feces. Al, samples were also examined using a sedimentation technique (Fluke Finder®) to detect eggs of the liver fluke, *Fascioloides magna*.

***Results***

**Bison**

Table 7 shows the results of the bison fecal examinations for eggs of trichostrongyle nematodes other than *Nematodirus*.

**Table 7 Bison: Fecal Examination Results – Trichostrongyles other than *Nemaotidirus*.**

| Farm | Number of Animals Tested | Number of Animals Positive for Trichostrongyles (%) | Mean Trichostrongyle Egg Count | Range of Trichostrongyle Egg Counts |
|---|---|---|---|---|
| 1 | 21 | 19 (90) | 37.4* | 0-219 |
| 2 | 18 | 16 (89) | 101.9 | 0-410 |
| 3 | 5 | 5 (100) | 40.4 | 24-57 |
| 4 | 9 | 6 (67) | 4.6 | 0-21 |
| 5 | 6 | 5 (83) | 10.5 | 0-42 |
| 6 | 10 | 8 (80) | 18.8 | 0-106 |
| 7 | 6 | 5 (83) | 20.5 | 0-46 |
| 8 | 6 | 6 (100) | 39.7 | 11-100 |
| 9 | 16 | 15 (94) | 57.5 | 0-250 |
| 10 | 17 | 15 (88) | 61.6 | 0-547 |
| 11 | 9 | 8 (89) | 56.2 | 0-280 |
| 12 | 10 | 2 (20) | 0.3 | 0-2 |
| 13 | 4 | 3 (75) | 9.8 | 0-23 |
| 14 | 46 | 42 (91) | 63.5 | 0-347 |
| 15 | 16 | 10 (63) | 6.6 | 0-31 |
| 16 | 14 | 11 (79) | 14.8 | 0-71 |
| 17 | 10 | 9 (90) | 57.7 | 0-204 |
| 18 | 48 | 39 (81) | 25.5 | 0-253 |
| 19 | 5 | 5 (100) | 23.2 | 4-43 |
| 20 | 3 | 3 (100) | 69.0 | 31-107 |
| 21 | 17 | 16 (94) | 93.9 | 0-462 |
| 22 | 19 | 13 (68) | 36.8 | 0-222 |
| | 315 | 261 (83) | 38.7 | 0-547 |

* Counts are eggs per 5 grams of feces

Fecal samples were examined from a total of 315 bison. Some of the animals on all farms had eggs of trichostrongyles (other than *Nematodirus*) in their feces. Between 20% and 100% of the animals examined on each farm were found to be infected with these parasites. All but four of the 22 bison producers reported using anti-parasite medications during 1998.

The overall mean trichcstrongyle egg count across the 22 bison farms was 38.7 eggs per 5 grams of feces. The mean counts on the farms ranged from 0.3 to 101.9 eggs per 5 grams. The maximum egg count recorded in an individual animal was 547 eggs per 5 grams. Egg counts of 100 eggs per 5 grams or higher were found on 13 (59%) of the farms, and in 44 (14%) of the bison.

Eggs of *Nematodirus*, a small-intestinal trichostrongyle with a life cycle different from that of the other trichostrongyles, were found in the feces of 17 bison (5.2% prevalence) from nine (45%) of the farms examined. Egg counts for this species were < 5 eggs per 5 grams, except for one animal with 29 eggs per 5 grams.

Eggs of *Strongyloides*, a non-trichostrongyle small-intestinal nematode, were recovered from the feces of one bison (3 eggs per 5 grams).

Eggs of *Trichuris* (whipworm), a large-intestinal nematode, were not recovered from the feces of any bison.

Table 8 shows the *Moniezia* (tapeworm) and coccidian fecal flotation results for bison.

**Table 8 Bison: Fecal Examination Results – *Moniezia* and Coccidia.**

| Farm | Number of Animals Sampled | *Moniezia* | | | Coccidia | | |
|---|---|---|---|---|---|---|---|
| | | Number Positive (%) | Mean Egg Count | Range of Egg Counts | Number Positive (%) | Mean Oocyst Count | Range of Oocyst Counts |
| 1 | 21 | 1 (5.0) | 9.4* | 0-198 | 15 (71.4) | 226.3* | 0-1658 |
| 2 | 18 | 8 (44.4) | 72.2 | 0-334 | 10 (55.6) | 68.8 | 0-700 |
| 3 | 5 | 0 | | | 4 (80.0) | 34.6 | 0-83 |
| 4 | 9 | 1 (11.1) | 12.2 | 0-110 | 1 (11.1) | 0.11 | 0-1 |
| 5 | 6 | 0 | | | 1 (16.7) | 0.83 | 0-5 |
| 6 | 10 | 0 | | | 4 (40.0) | 116.1 | 0-911 |
| 7 | 6 | 0 | | | 5 (83.3) | 8.17 | 0-29 |
| 8 | 6 | 0 | | | 0 | | |
| 9 | 16 | 1 (6.3) | 12.4 | 0-198 | 11 (68.8) | 56.4 | 0-480 |
| 10 | 17 | 4 (23.5) | 35.9 | 0-422 | 14 (82.5) | 61.0 | 0-838 |
| 11 | 9 | 6 (66.7) | 195.8 | 0-917 | 1 (11.1) | 0.11 | 0-1 |
| 12 | 10 | 2 (20.0) | 29.6 | 0-201 | 0 | | |
| 13 | 4 | 0 | | | 1 (25.0) | 62.3 | 0-249 |
| 14 | 46 | 13 (28.3) | 32.9 | 0-299 | 16 (34.8) | 10.2 | 0-253 |
| 15 | 16 | 0 | | | 4 (25.0) | 4.9 | 0-62 |
| 16 | 14 | 0 | | | 3 (21.4) | 3.7 | 0-25 |
| 17 | 10 | 2 (20.0) | 15.2 | 0-149 | 7 (70.0) | 47.0 | 0-289 |
| 18 | 48 | 11 (22.9) | 114.7 | 0-2202 | 4 (8.3) | 0.35 | 0-12 |
| 19 | 5 | 0 | | | 0 | | |
| 20 | 3 | 0 | | | 0 | | |
| 21 | 17 | 4 (23.5) | 11.6 | 0-88 | 4 (23.5) | 1.64 | 0-12 |
| 22 | 19 | 5 (26.3) | 4.4 | 0-83 | 5 (26.3) | 341.0 | 0-3509 |
| | 315 | 54 (17.1) | 220.9 | 0-2202 | 107 (34.0) | 160.4 | 0-3509 |

* Counts are eggs/oocysts per 5 grams of feces

**Elk**

Table 9 shows the results for the elk fecal examinations for eggs of trichostrongyles other than *Nematodirus*.

**Table 9 Elk: Fecal Examination Results – Trichostrongyles other than *Nematodirus*.**

| Farm | Number of Animals Tested | Number of Animals Positive for Trichostrongyles (%) | Mean Trichostrongyle Egg Counts | Ranges of Trichostrongyle Egg Counts |
|---|---|---|---|---|
| 1 | 6 | 0 (0) | 0 | |
| 2 | 10 | 9 (90) | 26.9* | 0-82 |
| 3 | 16 | 14 (88) | 31.6 | 0-128 |
| 4 | 66 | 62 (94) | 50.9 | 0-182 |
| 5 | 6 | 6 (100) | 23.3 | 3-54 |
| 6 | 6 | 3 (50) | 17.7 | 0-69 |
| 7 | 6 | 1 (17) | 0.2 | 0-1 |
| 8 | 6 | 6 (100) | 59.7 | 12-108 |
| 9 | 21 | 12 (57) | 1.8 | 0-9 |
| 10 | 5 | 0 (0) | 0 | |
| 11 | 8 | 2 (25) | 0.5 | 0-3 |
| 12 | 15 | 7 (47) | 20.3 | 0-153 |
| 13 | 14 | 7 (50) | 28.4 | 0-143 |
| 14 | 10 | 10 (100) | 35.4 | 1-192 |
| 15 | 13 | 13 (100) | 78.5 | 10-181 |
| 16 | 5 | 5 (100) | 68.8 | 18-128 |
| 17 | 49 | 24 (49) | 8.6 | 0-135 |
| 18 | 11 | 11 (100) | 30.2 | 2-63 |
| 19 | 26 | 25 (96) | 52.4 | 0-166 |
| 20 | 31 | 28 (90) | 59.9 | 0-347 |
| | 330 | 245 (74) | 29.8 | 0-347 |

Counts are eggs per 5 grams of feces

Fecal samples were examined from a total of 330 elk. Animals on 18 of the 20 farms had eggs of trichostrongyle (other than *Nematodirus*) in their feces. Between 17% and 100% of the animals examined on each of these 18 farms were found to be infected with these parasites. All of the elk producers included in this part of the study reported using anti-parasite medications during 1998.

The overall mean trichostrongyle egg count across the 22 farms was 29.8 eggs per 5 grams. The mean counts on the 18 farms ranged from 0.5 to 78.5 eggs per 5 grams of feces. The maximum egg count recorded in an individual animal was 347 eggs per 5 grams. Egg counts of 100 eggs per 5 grams or higher were found on 11 (55%) of the farms, and in 33 (10%) of the elk.

Eggs of *Nematodirus* were found in the feces of one elk (1 egg per 5 grams of feces).

Eggs of *Strongyloides* were found in 15 elk (4.5% prevalence) on six (30%) of the farms. Egg counts were all less than 30 eggs per 5 grams.

Eggs of *Trichuris* were found in nine elk (2.7% prevalence) on eight (40%) of the farms. Egg counts were all less than 10 eggs per 5 grams.

Table 10 shows the Moniezia (tapeworm) and coccidian fecal flotation results for elk.

**Table10 Elk: Fecal Examination Results – *Moniezia* and Coccidia.**

| Farm | Number of Animals Sampled | *Moniezia* | | | Coccidia | | |
|---|---|---|---|---|---|---|---|
| | | Number Positive (%) | Mean Egg Count | Range of Egg Counts | Number Positive (%) | Mean Oocyst Count | Range of Oocyst Counts |
| 1 | 6 | 0 | | | 0 | | |
| 2 | 10 | 0 | | | 3 (33.3) | 1.6* | 0-8 |
| 3 | 16 | 0 | | | 4 (25.0) | 7.6 | 0-88 |
| 4 | 66 | 2 (3.0) | 0.9* | 0-41 | 17 (25.8) | 3.3 | 0-64 |
| 5 | 6 | 0 | | | 0 | | |
| 6 | 6 | 0 | | | 0 | | |
| 7 | 6 | 0 | | | 0 | | |
| 8 | 6 | 0 | | | 2 (33.3) | 28.7 | 0-165 |
| 9 | 21 | 0 | | | 2 (9.5) | 0.1 | 0-1 |
| 10 | 5 | 0 | | | 1 (20.0) | 2.2 | 0-11 |
| 11 | 8 | 0 | | | 1 (12.5) | 0.3 | 0-2 |
| 12 | 15 | 0 | | | 4 (26.7) | 4.1 | 0-57 |
| 13 | 14 | 1 (7.1) | 7.3 | 0-102 | 2 14.3) | 7.0 | 0-95 |
| 14 | 10 | 0 | | | 0 | | |
| 15 | 13 | 4 (3.1) | 110.6 | 0-1185 | 1 (7.7) | 0.4 | 0-5 |
| 16 | 5 | 3 (60.0) | 130.8 | 0-284 | 0 | | |
| 17 | 49 | 1 (2.0) | 0.3 | 0-12 | 4 (8.2) | 0.3 | 0-7 |
| 18 | 11 | 0 | | | 0 | | |
| 19 | 26 | 0 | | | 0 | | |
| 20 | 31 | 0 | | | 2 (6.5) | 7.5 | 0-175 |
| | 330 | 11 (3.3) | 188.0 | 0-1185 | 43 (13.0) | 22.3 | 0-175 |

- Counts are eggs/oocysts per 5 grams of feces

# APPENDICES

## A: Postal survey questionnaire – bison.

**1999 Bison Parasite Questionnaire** APPENDIX A

We are attempting to gather information on parasitic infections and the use of anti-parasite medications on bison farms in Saskatchewan. Please take a few minutes to fill in this questionnaire by checking the appropriate box or filling the blanks provided. The first part of the questionnaire seeks basic information about your farm, the second part about parasites infecting your animals and the third about the use of anti-parasite medications on your farm.

All information sought is for calendar 1998. All information will be treated as confidential. Thanks for your help!

***Farm Information (for calendar 1998):***

1. How many bison did you have on your farm in 1998? 1 - 50 ☐ 51 - 100 ☐ 101 - 150 ☐ 151 - 200 ☐ >200 ☐
2. Did you feedlot any of your animals year round (summer and winter 98/99)? Yes ☐ No ☐
3. Approximately how many total acres were used for summer pasture? ____ acres
4. Did you rotate pastures? Yes ☐ No ☐
5. If yes, how often? About every ____ weeks
6. Were any of the pastures used for both summer grazing and winter feeding? Yes ☐ No ☐

***Parasites on your Farm (during calendar 1998):***

7. How often did you have laboratory fecal checks for parasites done on your herd during 1998?

   Once ☐ Twice ☐ When there was a problem ☐ Never ☐

8. If checks were done, what parasites were found?

   Gastro-intestinal worms ☐ Lungworms ☐ Other parasites ☐ (specify) _____
   Coccidia ☐ Liver flukes ☐

9. During calendar 1998, did any bison on your farm have parasite related health problems? Yes ☐ No ☐

10. If yes in question # 9, who made the diagnosis?

    You ☐ Another rancher ☐ Veterinarian ☐ Other ☐ (specify) _____

11. If yes in question # 9, how was this diagnosis made?

    Fecal exam ☐ *Post mortem* ☐ Poor weight gain ☐ Other ☐ (specify) _____

12. If yes in question # 9, do you know what parasites were involved?

    Gastro-intestinal worms ☐ Lungworms ☐ Other external parasites ☐ _____
    Coccidia ☐ Liver flukes ☐ Other parasites ☐ (specify) _____
    Ticks ☐ Lice ☐

Continue Over.....

***Anti-Parasite Medication Use on your Farm (during calendar 1998):***

13. Did you use anti-parasite medications in your herd in 1998? Yes ☐ No ☐

14. How frequently did you use anti-parasite medications in your herd in 1998?

Once ☐ Twice ☐ Only if problems ☐ Other ☐ (specify) _____ Never ☐

15. If you answered once or twice in question # 14:

a. Adult males - Which months of 1998 did you give anti-parasite medication?

| | | | |
|---|---|---|---|
| January ☐ | April ☐ | July ☐ | October ☐ |
| February ☐ | May ☐ | August ☐ | November ☐ |
| March ☐ | June ☐ | September ☐ | December ☐ |

b. Adult females - Which months of 1998 did you give anti-parasite medication?

| | | | |
|---|---|---|---|
| January ☐ | April ☐ | July ☐ | October ☐ |
| February ☐ | May ☐ | August ☐ | November ☐ |
| March ☐ | June ☐ | September ☐ | December ☐ |

16. Did you wean your calves in 1998? Yes ☐ No ☐

17. If yes in question # 16, did you give anti-parasite medication to your calves at weaning? Yes ☐ No ☐

18. Did you give anti-parasite medication to your calves at any other time(s) during 1998? Yes ☐ No ☐

If yes, during which month(s)? _____ Routine prevention ☐ Parasite problems ☐

19. Which anti-parasite medication(s) did you give to your animals during 1998? (check all medications given)

| | | | |
|---|---|---|---|
| Ivomec ☐ | Decoxx ☐ | Safeguard ☐ | Eprinex ☐ |
| Cydectin ☐ | Panacur ☐ | Valbazen ☐ | |
| Dectomax ☐ | Rumensin ☐ | Other ☐ (specify) _____ | |

20. How were the anti-parasite medication(s) given to your animals in 1998? (check all methods you used)

In feed ☐ By injection ☐ Pour-on skin ☐ Other (specify) _____

21. From which source(s) did you obtain information about parasites and about anti-parasite medications?

Veterinarian ☐ Other ranchers ☐ Industry magazines ☐ Other ☐ (specify) _____

*Any other comments?*

_____

_____

**End of survey ! Thanks for your time and effort!**

B: Postal survey questionnaire – elk.

**1999 Elk Parasite Questionnaire** APPENDIX B

We are attempting to gather information on parasitic infections and the use of anti-parasite medications on elk farms in Saskatchewan. Please take a few minutes to fill in this questionnaire by checking the appropriate box or filling the blanks provided. The first part of the questionnaire seeks basic information about your farm, the second part about parasites infectin your animals and the third about the use of anti-parasite medications on your farm.

All information sought is for calendar 1998. All information will be treated as confidential. Thanks for your help!

***Farm information (for calendar 1998):***

1. How many elk did you have on your farm in 1998? 1 - 50 ☐ 51 - 100 ☐ 101 - 150 ☐ 151 - 200 ☐ >200 ☐
2. Approximately how many total acres were used for summer pasture? ____ acres
3. Did you rotate pastures? Yes ☐ No ☐
4. If yes, how often? About every ___ weeks
5. Were any of the pastures used for both summer grazing and winter feeding? Yes ☐ No ☐

***Parasites on your Farm (during calendar 1998):***

6. How often did you have laboratory fecal checks for parasites done on your herd during 1998?

   Once ☐ Twice ☐ When there was a problem ☐ Never ☐

7. If checks were done, what parasites were found?

   Gastro-intestinal worms ☐ Lungworms ☐ Other parasites ☐ (specify) _____
   Coccidia ☐ Liver flukes ☐

8. During calendar 1998, did any elk on your farm have parasite related health problems? Yes ☐ No ☐
9. If yes in question # 8, who made the diagnosis?

   You ☐ Another rancher ☐ Veterinarian ☐ Other ☐ (specify) _____

10. If yes in question # 8, how was this diagnosis made?

    Fecal exam ☐ *Post mortem* ☐ Poor weight gain ☐ Other ☐ (specify) _____

11. If yes in question # 8, do you know what parasites were involved?

    Gastro-intestinal worms ☐ Lungworms ☐ Other external parasites ☐ _____
    Coccidia ☐ Liver flukes ☐ Other parasites ☐ (specify) _____
    Ticks ☐ Lice ☐

Continue Over.....

***Anti-Parasite Medication Use on your Farm (during calendar 1998):***

12. Did you use anti-parasite medications in your herd in 1998? Yes ☐ No ☐

13. How frequently did you use anti-parasite medications in your herd in 1998?

Once ☐ Twice ☐ Only if problems ☐ Other ☐ (specify)_____ Never ☐

14. If you answered once or twice in question # 13:

a. Adult males - Which months of 1998 did you give anti-parasite medication*

| | | | |
|---|---|---|---|
| January ☐ | April ☐ | July ☐ | October ☐ |
| February ☐ | May ☐ | August ☐ | November ☐ |
| March ☐ | June ☐ | September ☐ | December ☐ |

b. Adult females - Which months of 1998 did you give anti-parasite medication?

| | | | |
|---|---|---|---|
| January ☐ | April ☐ | July ☐ | October ☐ |
| February ☐ | May ☐ | August ☐ | November ☐ |
| March ☐ | June ☐ | September ☐ | December ☐ |

15. Did you give anti-parasite medication to your calves at weaning in 1998? Yes ☐ No ☐

16. Did you give anti-parasite medication to your calves at any other time(s) during 1998? Yes ☐ No ☐

If yes, during which month(s)? _____ Routine prevention ☐ Parasite problems ☐

17. Which anti-parasite medication(s) did you give to your animals during 1998? (check all medications given)

| | | | |
|---|---|---|---|
| Ivomec ☐ | Decox ☐ | Safeguard ☐ | Eprinex ☐ |
| Cydectin ☐ | Fenimex ☐ | Valbazen ☐ | |
| Dectomax ☐ | Rumensin ☐ | Other ☐ (specify) _____ | |

18. How were the anti-parasite medication(s) given to your animals in 1998? (check all methods you used)

In feed ☐ By mouth as drench ☐ By injection ☐ Pour-on skin ☐

19. From which source(s) did you obtain information about parasites and about anti-parasite medications?

Veterinarian ☐ Other ranchers ☐ Industry magazines ☐ Other ☐ (specify)_____

*Any other comments?*

_____

_____

End of survey ! Thanks for your time and effort!

C: Parasite Summary.

***PARASITE SUMMARY*** **APPENDIX C**

When fecal samples are examined (using a fecal flotation) for parasites, it is the worms' eggs that are recovered and identified. A flotation will also isolate protozoal (single cell) parasite oocysts from a fecal sample. These are the types of parasite eggs/oocysts that were found in the bison and elk samples collected during the summer of 1999.

**1) Trichostrongyle (Trichost)**

The eggs produced by this group of worms are all quite similar in size and shape. We cannot determine, therefore, the exact species infecting an animal shedding these types of eggs. The adult worms are found in the stomach (abomasum), or small or large intestine. They are small (~1/2 to 2 cm) hairlike worms. They have a direct life cycle involving development of eggs to infective larval (immature) stages on the pasture. Infection occurs when these larvae are eaten along with food material. They are the most economically important parasites in domestic ruminants but little is known about their effects on ranched elk or bison.

Parasites producing this type of egg include:

*Cooperia* spp. *Oesophagostomum* spp. *Ostertagia* spp.
*Haemonchus* sp. *Trichostrongylus* sp.

**2) *Nematodirus* sp. (Nemat)**

This worm is also a trichostrongyle (see above) and has a similar life-cycle. It is somewhat larger and lives exclusively in the small intestine. Eggs from this parasite are also larger and have a distinct "football" shape. *Nematodirus* sp. is most commonly seen in younger animals (<1 yr). Older animals appear to develop a strong immunity. It is not thought to be a problem unless found in very large numbers.

**3) *Trichuris* sp.**

*Trichuris* sp. is a worm found in the caecum and colon of both elk and bison. The eggs have a very distinct "lemon" shape. These parasites are 5-6 cm long and are whip-like in appearance with a long slender anterior (2/3 of length) and a shorter broad posterior (1/3 of length). Infection is not usually a problem but may be associated with mucoid diarrhea in young animals, and then only when found in large numbers. It has a direct life cycle. Eggs containing larvae are infective.

**4) *Strongyloides* sp. (Strong)**

*Strongyloides* sp. are very small worms (<6mm) and are found in the small intestine. The eggs are also very small and have a distinctive larvae inside the egg. This parasite is uncommon but can be a problem in calves housed in unsanitary conditions, causing watery diarrhea. The infective larvae enter the animals by being eaten or penetrating the skin.

**5) *Moniezia* sp.**

This is a tapeworm found in the small intestine of ruminants. This large worm is generally considered not to be harmful to its host. It has a triangular shaped egg which is easily recognized. This parasite uses a small, free-living mite as the intermediate host required to complete the life cycle.

**6) Coccidia (*Eimeria* sp.)**

A variety of related protozoan (single celled) parasites infect elk and bison, usually inhabiting cells of the lining of the small intestine. Very little is known about the effects of these parasites in ranched animals. In cattle these parasite may cause diarrhea, but usually only in calves.

**RELATIVE SIZE AND SHAPE OF EGGS AND OOCYSTS FOUND IN SASKATCHWAN ELK AND BISON**

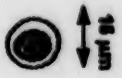
***Trichostrongyle***

***Nematodirus* sp**

***Trichuris* sp.**

***Strongyloides* sp egg**

***Moniezia* sp. egg**



**Coccidia (*Eimeria* sp.) oocyst**